# BATTLESPACE TERRAIN OWNERSHIP: A NEW SITUATION AWARENESS TOOL

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## ABSTRACT

Information in the battlespace provides decisive power. It is imperative that critical information is brought to the immediate attention of commanders to enhance decision-making. One vital piece of information is terrain control. The Battlespace Terrain Ownership (BTO) system embodies an algorithm that computes expected terrain control over time and space, based on combat power projection as a function of position, influence exerted by asset distribution, weapon system effectiveness, probabilities of hit and kill, and combat damage. Knowing controlled terrain enables safer sustaining operations and translates into saving lives.

## 1. INTRODUCTION

Situation Awareness (SA) has been defined as "the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future." (Endsley, 1988) A good SA tool integrates disparate information to facilitate battlespace understanding. Reducing tactical information into a less complex form enables the commander to perceive the repercussions of military actions in both operational planning and battlefield execution. We are designing a Battlespace Terrain Ownership (BTO) system prototype to provide the commander critical terrain control information in an easily understood and visual display.

## 2. BTO CONCEPT

Terrain control is a vital piece of battlefield information. A commander can gauge how well a battle is progressing by knowing what forces control significant terrain. Future commanders should be able to assess control at any time in a quick and efficient manner. We use modern methods of computation and graphic display to present dynamic battlespace information in a form immediately useful and intuitively graspable. The BTO system, under development as an ARL prototype software tool, provides future commanders with a graphical visualization of asset effectiveness in gaining or maintaining control of battlespace terrain regions. The BTO system embodies an algorithm that computes expected terrain control over time and space, based on combat power projection as a function of position, influence exerted by asset distribution, weapon system effectiveness, probabilities of hit and kill, and combat damage.

The BTO system prototype incorporates battle status information from the One Semi-Automated Forces (OneSAF) Testbed Baseline simulation. OneSAF scenarios yield streams of real-time battle data, including vehicle position, entity status, and fire information consisting of when a direct fire hit occurs and identification of the firer and the target. The data is the input for the BTO visualization system and is received via a Java software interface.

## 3. BTO VISUALIZATION

We classify control based on the ratio of combat power projected onto an area by opposing forces, B (United States friendly forces) and R (threat forces). The ratio of power is designated by "r." The BTO system terrain control classes are: r >= 3:1, 2:1 =< r < 3:1 in favor of B or R. Further, there is a single class for r < 2:1 describing areas where the forces are more evenly matched and are the areas of most concern to commanders.

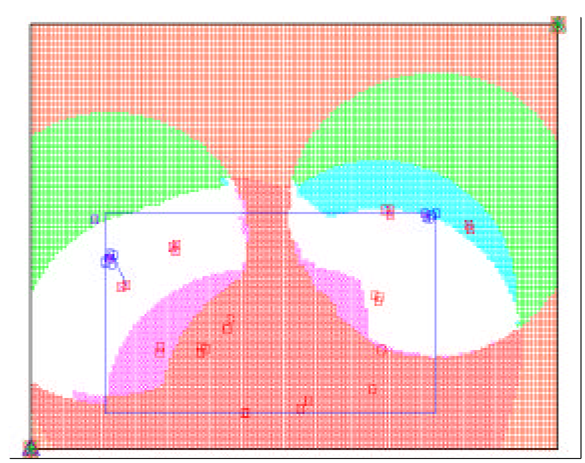

Figure 1

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A terrain control visualization is shown in Figure 1. The BTO system colors the areas of control where r >= 3:1 green for B forces and red for R forces. B/R force ratios for 2:1 =< r < 3:1 are color coded aqua and purple respectively; B/R force ratios for r < 2:1 are color coded white. A less intense reddish tone, as seen at the top of Figure 1, indicates areas of no influence due to weapon range restrictions.

Several plotting options are available in the BTO system prototype. For example, again in Figure 1, the inset rectangle represents an active battle area. An active area contains vehicles having firepower capability.

B/R entities are represented by squares and are color-coded blue and red respectively. Those entities more seriously damaged are represented by X-filled squares. Although Figure 1 shows the entire battlespace, BTO can be restricted to the active battle area.

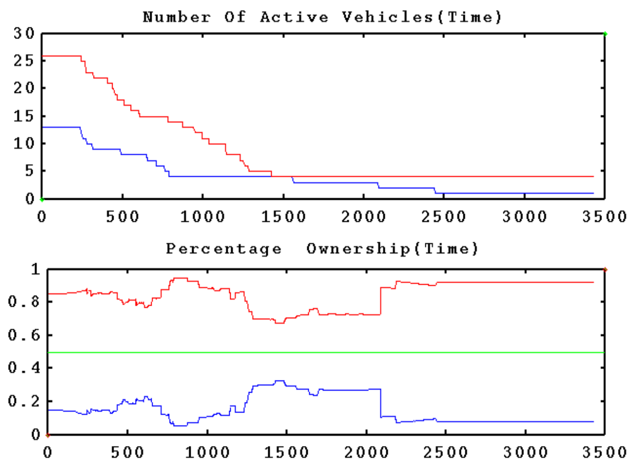


Figure 2

The upper graph of Figure 2 shows the number of vehicles having a firing capability (i.e., including entities with capable weapons but without mobility.) The BTO system prototype has the ability to graphically plot battlefield terrain ownership as a function of time and is restricted to ownership in the active area. The lower graph provides an estimate of overall control based on actual firepower projections, rather than on discrete force-ratio classes.

## 4. CONCLUSION

The BTO system is our first tool designed for a statistically-based automated tool set capable of providing battlespace analyses that describe occurrences key to the success of a military operation. (O'May, et al., 2003) Using a novel algorithm to mine battlespace data, BTO renders a dynamic real-time display of terrain ownership that improves commanders' SA. While the prototype receives data from simulated sources, it is our intent that the final version will monitor actual battlefield sensor feeds. We will sponsor a series of experiments to quantify the worth of this technology. Tools such as BTO will enable rapid SA and help create a future force with enhanced battlespace agility and improved combat initiative.

## ACKNOWLEDGEMENTS

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